



## The ACES Project - Large-scale Integration of Electric Vehicles into the Electric Power System

**Marinelli, Mattia**

*Published in:*  
Sustain Conference 2018

*Publication date:*  
2018

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*  
Marinelli, M. (2018). The ACES Project - Large-scale Integration of Electric Vehicles into the Electric Power System. In C. Melero, & K. Mølhave (Eds.), *Sustain Conference 2018: Creating Technology for a Sustainable Society* [E-6] Technical University of Denmark. <http://www.sustain.dtu.dk/>

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

## The ACES Project - Large-scale Integration of Electric Vehicles into the Electric Power System

Mattia Marinelli

CEE – Center for Electric Power and Energy, Department of Electrical Engineering, DTU Risø Campus

Corresponding author email: [matm@elektro.dtu.dk](mailto:matm@elektro.dtu.dk)

In the quest for sustainable development and integration of renewable energy sources, electric vehicles (EVs) can play a pivotal role. EVs, however, are not primarily designed and utilized for supporting the electrical grid: it is necessary to close the gap between power system needs and cars' properties. With this in mind, the ACES (Across Continents Electric Vehicle Services) project, a Danish funded research project, was started as collaboration between DTU, Nissan, Bornholm Energi og Forsyning and NUVVE. The project investigates techno-economic system benefits of large-scale electric vehicles integration in Bornholm, augmented by real usage patterns, grid data and field-testing for across continents replicability. This abstract gives a brief overview of the mid-term results on EVs providing both system wide and local grid services. The indicated references and the project website report further details: [www.aces-bornholm.eu](http://www.aces-bornholm.eu)

When looking at the system level, EVs bidding into the ancillary services market, specifically frequency control, can be very remunerative, up to 10000 DKK/y. However, the need for extra equipment such as a bidirectional charger, the cost for associated losses and need to fulfill bid requirements can drastically reduce the profit [1]. The work in [2] proves that EVs can effectively replace conventional power plants for supporting more renewables into the power system. On the other hand, at the distribution grid level, by considering pseudo-real Japanese and Danish driving and charging patterns, it is highlighted how a 100% EV penetration would determine an evening peak concurrency factor equal to 40% for a 3.7 kW charge level [3]. The average distribution grid in Denmark would be able to handle a 50% EV scenario, though safety margins are reduced. Smart charging options can, however, increase the hosting capacity and avoid grid reinforcements [5].

### References

- [1] A. Thingvad, C. Ziras, J. Hu, M. Marinelli, "Assessing the Energy Content of System Frequency and Electric Vehicle Charging Efficiency for Ancillary Service Provision," *Universities Power Engineering Conference (UPEC), 2017 Proceedings of the 52<sup>nd</sup> International*, Heraklion, 29 Aug. – 1 Sep. 2017.
  - [2] A. Zecchino, A. M. Prostejovsky, C. Ziras, M. Marinelli, "Large-scale Provision of Frequency Control via V2G: the Bornholm Power System Case," *Electric power system research*, under review.
  - [3] L. Calearo, A. Thingvad, K. Suzuki, M. Marinelli, "Grid Loading due to EV Charging Profiles Based on Pseudo-Real Driving Pattern and User Behaviour," *Energy*, under review.
  - [4] A. Gadea, M. Marinelli, A. Zecchino, "A Market Framework for Enabling Electric Vehicles Flexibility Procurement at the Distribution Level Considering Grid Constraints," *20<sup>th</sup> Power System Computation Conference (PSCC)*, Dublin, 11-15 Jun. 2018.
  - [5] K. Knezović, M. Marinelli, A. Zecchino, P. B. Andersen, C. Træholt, "Supporting involvement of electric vehicles in distribution grids: Lowering the barriers for a proactive integration," *Energy*, vol. 134, 2017.
-